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Crotalus tortugensis Van Denburgh and Slevin
Tortuga Island Rattlesnake

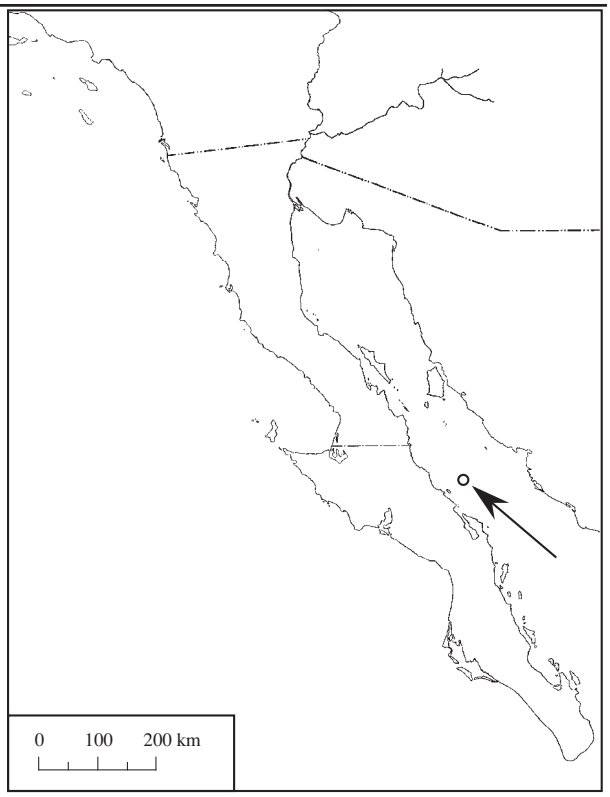
Crotalus tortugensis Van Denburgh and Slevin 1921:398. Type locality, "Tortuga Island, Gulf of California, [Baja California Sur] Mexico." Holotype, California Academy of Sciences (CAS) 50515, adult male, collected by J.R. Slevin, 22 June 1921 (examined by CLS).
Crotalus atrox sonoraenis: Amaral 1929:85.
Crotalus atrox tortugensis: Stejneger and Barbour 1933:133.

• **CONTENT.** The species is monotypic.

• **DEFINITION.** *Crotalus tortugensis* is a medium sized rattlesnake, smaller than its nearest relative, *C. atrox* (Murphy et al. 2002), with large males reaching one meter in total length. The largest specimen on record is 1058 mm total length (Klauber 1972). This species is heavy-bodied and stout, with a triangular head. The head length is approximately 3.8% of the total body length for adult males, compared to 4.5% for males of *C. atrox* (Spencer 2003), a characteristic that may indicate dwarfing (Campbell and Lamar 1989). The scutellation is as follows (ranges and means are based on measurements of 39 snakes by CLS; all head scale counts are for right side only): midbody scale rows, 23–27 (25.8); ventrals (following the method of Dowling 1951), 174–194 (183.4); preventrals, 2–6 (3.7); subcaudals, 16–25 (21.4); canthals, 2; intercanthals, 1–3 (1.8); scales before supraoculars, 9–21 (15); minimum scale rows between supraoculars, 4–5 (4.4); nasals, 2; internasals, 0–1 (0.8); loreals, 1–2 (1.0); preoculars, 2; suboculars, 3–4 (3.2); interoculabials, 2–3 (2.3); location of postocular pale stripe (number of scales anterior to the rictus, 0 is at rictus), 0–3 (1.5); interrictals, 25–32 (28.8); prefoveals, 4–9 (5.8); postfoveals, 2–4 (3.7); lacunals, 2; supralabials, 14–17 (15.3); infralabials, 14–19 (16.6); percent divided first infralabials, 18.0%; gulars, 5–8 (6.5); intergenials, 0–1 (0.18); percent prenasal contact with first supralabial, 97%; percent postnasal contact with preocular, 5.1%; number of body blotches, 29–41 (35.4); number of tail rings, 3–6 (4.6); and number of rattle fringe scales, 10–18 (12.7).

Adult male body size ranges from 592–1058 mm and adult female body size from 651–881 mm (Klauber 1972; this study). Other mensural characters are as follows (range of measurements noted in mm; methods follow Spencer 2003; measurements of the right side of the head are listed where applicable) for adults males: ratio of rostral height to rostral length, 0.88–1.34 (1.09); head length, 26.10–38.10 (33.60); head height, 8.05–17.65 (11.25); head width, 18.50–28.50 (23.60); and tail length, 41–77 (61). Other mensural characters for adult females are as follows (see previous notes): ratio of rostral height to rostral length, 0.85–1.43 (1.08); head length, 26.60–40.65 (32.36); head height, 6.00–13.60 (10.78); head width, 17.60–25.10 (22.14); and tail length, 37–60 (48).

Dorsal ground color is gray to dark brown, often with a purplish or pinkish tinge. The head has scattered black flecks. Body blotches are purplish-brown to dark brown, and are diamond or hexagonal-shaped with black mottling. The margins of blotches on the anterior two-thirds to three-fourths of the body are white or buff along the dorsal midline; these light margins are absent along the lateral edges of the blotches (Campbell and Lamar 1989). The body is punctuated with small black spots, creating a dusty look. Pale colored pre- and postocular stripes are present.



MAP. The circle indicated by an arrow points to Isla Tortuga, the type locality and entire known range of *Crotalus tortugensis*.

FIGURE. *Crotalus tortugensis* from Isla Tortuga, Baja California Sur, México (photograph by L.L. Grismer).

The pale postocular stripes end before the rictus of the mouth. A darker stripe is present posterior to the pale postocular stripe. Similar to *C. atrox*, the tail has a distinctive and contrasting color pattern of black and ash-white alternating stripes. The black caudal rings are as wide or wider than the white rings and the black rings are sometimes not continuous.

• **DIAGNOSIS.** *Crotalus tortugensis* is most similar to *C. atrox*, with differences in the dorsal blotches (diamonds) being the most noticeable divergence. The blotches are less distinct than in *C. atrox*. In *C. tortugensis*, the margins of the blotches are much darker than the central portion and usually "include on each side [of the blotch] a group of lighter scales as pale as the general dorsal ground color" (Van Denburgh and Slevin 1921). These

paler colored scales may be found throughout the blotches and may connect across the dorsum. Klauber (1930) stated that the "light borders of the diamonds characteristic of *atrox* are absent except along the middorsal line," and Grismer (2002) noted that the white scales of the anterior borders of the diamonds are often reduced or absent in *C. tortugensis*, and that the diamonds fade posteriorly.

A unique trait noted by several authors is the absence of an upper (second) loreal in *C. tortugensis* (Klauber 1972, Campbell and Lamar 1989, Grismer 2002). Of 39 *C. tortugensis* examined in this study (CLS), 38 specimens had a single loreal, with only one snake (SDSNH 27082) having two loreals on both right and left sides of head. The postnasal and preocular scales are rarely in contact (3–5%; Klauber 1930; this study). In *C. atrox*, the opposite trend occurs with 94–95% of snakes having the postnasal in contact with the preocular scale or contact prevented by a loreal, usually the upper loreal (Klauber 1930, Spencer 2003).

An additional scale character that differentiates *C. tortugensis* from *C. atrox* is the intergenials. In *C. tortugensis*, 25.6% of the snakes examined (10 of 39) possessed at least one intergenial scale. Four of 39 (10.3%) snakes had two intergenials, one on both the left and right sides of the jaw. This scutellation was not observed in 922 *C. atrox* examined (Spencer 2003).

Brattstrom (1964) noted an osteological difference between *C. tortugensis* and *C. atrox*, namely that *C. tortugensis* had a squamosal relatively shorter than does *C. atrox*. This is one of the few osteological characters in which *C. tortugensis* falls outside the range of measurements of *C. atrox* (Brattstrom 1964).

Crotalus tortugensis can be differentiated from *C. ruber* by the percent of division between the first infralabials. *Crotalus ruber* has a higher frequency of divided first infralabials (90–100%; Klauber 1930) compared to only 11–18% of individuals possessing the same character in *C. tortugensis* (Klauber 1930; this study). *Crotalus tortugensis* may be differentiated from *C. ruber exsul* by possessing fewer numbers of intergenials. Klauber (1930) found that 92% of *C. r. exsul* had intergenials, whereas only 15–26% of *C. tortugensis* have intergenials (Klauber 1930; this study). *Crotalus tortugensis* can be differentiated from all remaining *Crotalus* by two characters: the postocular stripe ending at or before the rictus and the tail having alternating black and white rings that are in marked contrast to the body color.

• **DESCRIPTIONS.** The original description was published by Van Denburgh and Slevin (1921). Additional descriptions appeared in Van Denburgh (1922), Gloyd (1940, 1978), Campbell and Lamar (1989, 2004), Mattison (1996), Rubio (1998), McPeak (2000), and Grismer (2002).

• **ILLUSTRATIONS. Black and white photographs** of *Crotalus tortugensis* were published in Gloyd (1940), Klauber (1956, 1972), Harris and Simmons (1977, 1978), and Glenn and Straight (1982). **Color photographs** were published in Campbell and Lamar (1989, 2004), Mattison (1996), Rubio (1998), McPeak (2000), and Grismer (2002). A black and white photograph published by Harris and Simmons (1977) and a color photograph in Grismer (2002) depict the habitat on Isla Tortuga.

• **DISTRIBUTION.** *Crotalus tortugensis* is endemic to Isla Tortuga, Baja California Sur, México.

• **FOSSIL RECORD.** None.

• **PERTINENT LITERATURE.** Murphy (1976, 1982, 1983a, b), Grismer (1994a,b), Mattison (1996), and Murphy and Aguirre Léon (2002) discussed the **origin and evolution** of *C. tortugensis* in Baja California. **Phylogenetic relationships** were discussed by Cliff (1954a,b), Klauber (1956, 1963, 1972), Radcliffe and Maslin (1975), Campbell and Lamar (1989, 2004), and Murphy et al. (1989, 2002). Case (1983, 2002) commented on the **relationship of body size to prey size and availability**.

Additonal aspects of biology are as follows: **evolution** (Brattstrom 1964, Murphy et al. 2002), **evolution of insular body size** (Case 1978), **taxonomy** (Schmidt 1922; Werner 1923; Harris and Smith 1979; Underwood 1979; Mattison 1996; Rubio 1998; Grismer 1999a, 2002; Campbell and Lamar 2004), **morphology** (Klauber 1936a,b, 1937, 1938, 1939, 1940, 1943; Amaral 1944; Cliff 1954a,b; Altman and Ditmer 1962; Stille 1987; Campbell and Lamar 1989, 2004), **venom** (Klauber 1956, 1972; Bücherl and Buckley 1971; Brown 1973; Gans 1978; Russell 1979, 1980; Glenn and Straight 1982, 1985; Mattison 1996), **genetics** (Stewart and Morafka 1989, Stewart et al. 1990), **physiology** (Skoczylas 1978), **courtship and mating behavior** (Armstrong and Murphy 1979), **natural history** (McPeak 2000, Grismer 2002), **reproduction** (Mattison 1988, Grismer 2002), **diet** (Van Denburgh 1922; Klauber 1956, 1972), **parasites** (Riley and Self 1979, Rego 1980/1981), **conservation** (Tryon 1986, Flores Villela and Gerez Fernandez 1988), **longevity** (Perkins 1948, 1950, 1951, 1952, 1953, 1954, 1955; Shaw 1957; Bowler 1977; Slavens 1978–2000; Snider and Bowler 1992), and **captive management** (Perkins 1948, 1950, 1951, 1952, 1953, 1954, 1955; Shaw 1957; Murphy and Armstrong 1978; Slavens 1978–2000; Anonymous 1979; Mattison 1988; Snider and Bowler 1992).

The following authors mentioned its **occurrence on Isla Tortuga, Baja California**: Schmidt (1922), Ditmars (1930, 1931), Klauber (1930, 1956, 1971, 1972, 1982), Martín del Campo (1935), Mayr (1942), Savage (1952), Cliff (1954a,b), Wright and Wright (1957), Lindsay (1962, 1964), Carlquist (1965), Hoge (1966), Soulé and Sloan (1966), Russell (1969), Hoge and Romano (1971), Caras (1974), Ruth (1974), Harris and Simmons (1977, 1978), Armstrong and Murphy (1979), Underwood (1979), Kisser (1980), Hoge and Romano-Hoge (1981), Kilmon (1981), Russell (1983), McCoy (1984), Murphy and Ottley (1984), Phelps (1984), Mattison (1986, 1996), Grismer (1990, 1999b, 2002), Flores Villela (1993), McDiarmid et al. (1999), McPeak (2000), and Nabhan (2003). Wright and Wright (1957), Harris and Simmons (1977, 1978), Campbell and Lamar (1989, 2004), and Grismer (2002) provided **maps** showing the distribution of the species.

Crotalus tortugensis has been included in the following **type lists:** Smith and Taylor (1950) and Slevin and Leviton (1956), **checklists**: Stejneger and Barbour (1923, 1933, 1939, 1943), Smith and Taylor (1945), Loomis et al. (1974), Harding and Welch (1980), Hoge and Romano-Hoge (1981), Murphy (1983c, 2002), Golay et al. (1993), Rubio (1998), and Grismer (1999b), **taxonomic keys**: Cliff (1954a,b), Klauber (1956, 1971, 1972), Wright and Wright (1957), Smith and Taylor (1966), Sanborn and Loomis (1976), De Lisle (1978), and Campbell and Lamar (2004), **scientific and common names lists**: Cuesta Terron (1931), Martín del Campo (1937, 1950), Wright and Wright (1952), Klemmer (1963), Rosenberg (1987), Sokolov (1988), and Liner (1994), and **bibliographies**: Perez Avramow (1969) and Smith and Smith (1976, 1993). Minton et al. (1968) included *Crotalus tortugensis* in a list of venomous snakes occurring in México. Descriptions of habitat were published in Lindsay (1964), McCoy (1984), Mattison (1996), McPeak (2000), and Grismer (2002).

• **ETYMOLOGY.** The name *tortugensis* refers to Tortuga Island, Baja California Sur, México, where the species is endemic.

• **COMMENTS.** *Crotalus tortugensis* is not well differentiated from *C. atrox*. Murphy et al. (2002) and Grismer (2002) main-

tain its status as a separate species, although Murphy et al. (2002) stated that the relationships among the western species of the "*atrox*" group are tenuous. Preliminary ND4 mtDNA sequence data suggest that *C. atrox* is paraphyletic with respect to *C. tortugensis* and all insular forms of *C. atrox* (Castoe, Spencer, and Parkinson, unpublished data).

• **SPECIMENS EXAMINED.** *Crotalus tortugensis*, México: Baja California Sur, Isla Tortuga: CAS 50515 (holotype), 51319, 51320, 51321, 51322, 51323, 51324, 51326, 51327, 51328, 51329, 51330, 51331, 51333, 51334, 51335, 100378, 141792, 204071, 204073, 204074, 204075; CAS-SU 14028; SDSNH 25448, 26798, 26799, 26800, 26801, 26802, 26803, 26804, 26805, 26806, 27077, 27078, 27079, 27080, 27081, 27082.

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KENT R. BEAMAN, Section of Herpetology, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, CA 90007 (heloderma@adelphia.net) and **CAROL L. SPENCER**, Museum of Vertebrate Zoology, 3101 Valley Life Science Building, University of California, Berkeley, CA 94720-3160 (atrox@berkeley.edu).

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